**Examination Questions**

**“Monte Carlo Methods and Applications”**

**a first-year Bachelor, specialty Mathematical and Computer Modeling, fifth half-year, credit 3**

**Block A.**

1. **Complicated questions (Difficult problem).**
2. Methods of simulations of random variables.
3. Pseudo-Random Number Generator.
4. Uniform Random Variable on the interval . Uniform Simulation. Algorithm a Uniform Pseudo-Random Number Generation.
5. The Inverse Transform. Optimal Algorithms.
6. General Transformation Methods. Accept-Reject Methods.
7. **Average complexity questions.**
8. Modelling algorithm of uniformly distributed variable on the interval .
9. Modelling algorithm random variables.
10. Modelling algorithm random vectors.
11. Method Inverse Function.
12. Random selection vector in 3-d space.
13. **Elementary questions.**
14. Random variable.
15. Distribution Function.
16. PDF – Probability Density Function.
17. Numerical measures (moments) of random variable.
18. Characteristic function

**Block B.**

* 1. **Complicated questions (Difficult problem).**

1. Chebyshev Inequality.
2. Classic Monte Carlo Integration.
3. Essential samples method. To prove a theorem.
4. Modelling Algorithm of Markov Chains.
5. The Solution of the Linear Algebraic Equations System (LAES).
6. Computation of the Queuing System.
7. Computation of the neutron passing through of plate.
   1. **Average complexity questions.**
8. The Solution of the Integral Equation (IE). Neumann series.
9. Calculation of the ,  and .
10. Calculation of the .
11. Unbiased Estimate  and to prove a theorem .
12. Variance of Basic Estimator.
13. Essential sample. Theorem.
14. Example of Integral Equation.
    1. **Elementary questions.**
15. The solution algorithm LAES. The Numerical Example.
16. Integration of the .
17. To prove which the Integral have of the Best Estimate for .
18. Building Algorithms of “Weights”.
19. Estimates with Zero Variance.
20. Estimation of Conjugate Integral Equation.
21. Estimation of capture and others Estimations.

**Block C.**

1. **Complicated questions (Difficult problem).**
2. The Solution of the Boundary Value Problem of Poisson Equation.
3. The Solution of the Boundary Value Problem of Helmholtz Equation.
4. Green function of Helmholtz operator of the ball.
5. Algorithms “Random walks on spheres” and “Random walks on lattices”.
6. Continuous Markov Chains. Theorem of Variance.
7. **Average complexity questions.**
8. Basic Biased Estimator of the Solution of Boundary Value Problem of Helmholtz Equation.
9. Basic Biased Estimator of the Solution of Boundary Value Problem of Poisson Equation.
10. Estimate of Derivative of the Solution.
11. Estimate per Parameter of the Solution.
12. Precision of estimate of Solution.
13. **Elementary questions.**
14. The Numerical Example of the Solution of the Boundary Value Problem of Helmholtz Equation.
15. The Numerical Example of the Solution of the Boundary Value Problem of Poisson Equation.
16. Modelling Algorithm the some Random Values.
17. Idea of Monte Carlo Methods.
18. The Modelling of Transport Process Radiation (The Example IE).

Professor Kanat Shakenov

November 5, 2015